EFFECT OF KNEE OSTEOARTHRITIS ON FUNCTIONAL CAPACITY AND QUALITY OF LIFE IN ELDERLY WOMEN

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THE SYNOPSIS

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1. INTRODUCTION

KNEE OSTEOARTHRITIS:

The disabling disorders that have an impact on people's ability to work include arthritis. Degenerative joint disease, sometimes known as osteoarthritis, is a set of overlapping separate disorders that may have many a etiologies but share a number of biochemical, morphologic, and clinical characteristics.

Osteoarthritis is characterised by the deterioration of the joints' articular cartilage and subchondral bone. Ligaments, the capsule, and the synovial membrane all degenerate as well. Pain and loss of functionality will result.

ETIOLOGY:

The most prevalent joint condition in adults globally is osteoarthritis. Age increases the likelihood of it. Extrinsic and intrinsic risk factors support its growth. While both the right and left knees are about equally likely to be damaged in women, the right knee is more frequently impacted in males aged 60 to 64. Asymmetry between matrix production and matrix degradation in healthy cartilage can lead to chondral loss when it is caused by acute or chronic stress, such as natural wear and tear, ageing, obesity, and joint injury.

Following the presentation of the mechanisms of degeneration, descriptions of the endogenous and exogenous variables thought to have a role in the progression of osteoarthritis are given-

- Obesity,
- joint hypermobility and instability,
- sports stress with high impact loading,
- repetitive knee bending or heavy lifting,
- a particular vocation,
- peripheral neuropathy,
- knee joint injury,
- a history of immobilisation,
- and family history are additional risk factors.

CLINICAL FEATURES:

Osteoarthritis symptoms include discomfort that is present before, during, and after movement. Patients exhibit loss of function through stiffness, a reduction in range of motion, and difficulties performing ADLs. Crepitus, joint line discomfort, bone expansion, and heightened sensitivity are its defining characteristics.

Five phases of osteoarthritis are distinguished:

• Stage 0 refers to healthy knees with no joint discomfort.

• Stage 1: There is no discomfort and just very modest bone spur development.

• Satge2: discomfort after prolonged walking, joint stiffness, and more rapid bone spur formation.

• Stage 3: recurring discomfort during motion, increased joint stiffness, and shrinking joint space.

• Stage 4: the cartilage has completely disappeared, the synovial fluid has diminished, and walking causes significant pain and suffering.

2. REVIEW OF LITERATURE

The purpose of this literature review is to review: 1) the prevalence, anatomy, etiology, pathology, and consequences of knee osteoarthritis (OA); 2) current treatment strategies for patients with knee OA and their impact on functional performance and self-reported outcomes; and 3) methods for assessing functional performance and self-reported outcomes in patients with knee OA.

2.1 Prevalence

Knee OA is a very common disease seen in elderly populations, with 12% of people, ages 60 and older, showing symptoms of knee OA, including severe disability, pain and a decreased general well-being of individuals or quality of life.1,3 Dillon et al. 1 found that females have a higher prevalence of knee OA than males, with 42% of women ages 65-74 showing radiographic signs of knee OA compared to 31% of males in the same age group. It was also found that an increasing age, increasing body mass index, and being of a non-Hispanic Black race/ethnicity was linked with increased disease prevalence. Rosemann et al. 3 investigated 1311 male and female patients with OA of the hip or knee and found differences between men and women in aspects of quality of life. Women were more greatly affected in terms of physical disability than men assessed by the AIMS2-SF lower body scale (women: 2.98; men: 2.39; $P<0.01$). Furthermore, women showed significantly lower mood and significantly higher pain in comparison to men, assessed by the AIMS2-SF affect scale (women: 3.10; men: 2.60; $P<0.01$) and symptom scale (women: 5.12; men: 4.49; $P<0.01$).

2.2 Tibiofemoral Joint Anatomy

2.2.1 Musculature

The tibiofemoral joint is classified as a synovial joint that allows for flexion and extension motions to occur at the knee. Musculature that crosses the tibiofemoral joint includes the quadriceps and hamstrings muscle groups, the two heads of the gastrocnemius, and the popliteus. The quadriceps muscle group extends the knee and is comprised of the rectus femoris, vastus lateralis, vastus medialis, and the vastus intermedius muscles, all of which insert onto the tibial tuberosity via the patellar ligament. The hamstrings muscle group flexes the knee and is comprised of the biceps femoris, semitendinosus, and the semimembranosus. The biceps femoris is located laterally, originates on the ischial tuberosity and lateral lip of the linea aspera, and inserts onto the head of the fibula. The semitendinosus and semimembranosus are both located medially, originate on the ischial tuberosity, and insert onto the proximal, medial shaft of the tibia and the posterior aspect of the medial condyle of the tibia, respectively. The quadriceps and hamstrings muscle groups also help to provide stabilization of the tibia against translation forces alongside the anterior cruciate ligament (ACL) and the posterior cruciate ligament. (PCL) The quadriceps limit posterior movement of the tibia relative to the femur,

while the hamstrings limit anterior translation of the tibia on a fixed femur, serving as an agonist to the ACL. Furthermore, the quadriceps and hamstrings muscle groups provide dynamic knee stabilizing factors in the frontal plane. Due to their adduction and abduction moment arms, the co-activation of these muscles are the primary strategy to provide stability against varus and valgus moments at the knee. Frontal plane stabilization is important since instability has been shown to be a risk factor for the progression of knee OA.

The gastrocnemius muscle originates on the condyles of the posterior femur and crosses the knee to insert onto the calcaneus via the Achilles tendon. The gastrocnemius' main function is to plantar flex the talocrural joint but also to flex the knee. In patients with knee OA, elevated levels of gastrocnemius muscle activity have been observed compared to healthy persons. Specifically, patients demonstrate increased quadriceps/gastrocnemius muscle co- activation. It is believed that this increase in coactivation stabilizes the tibiofemoral joint in patients who experience joint laxity.24 The popliteus muscle originates on the lateral epicondyle of the femur and inserts onto the proximal, posterior aspect of the tibia. The popliteus aids in flexion at the knee. The popliteus muscle has not been implicated in the initiation or progression of tibiofemoral OA.

2.2.2 Ligaments

Ligaments of the tibiofemoral joint include the ACL and PCL and the medial and lateral collateral ligaments, which all act to provide stabilization to the knee. The ACL is an intra-articular ligament that is composed of two different bundles, the anteromedial and posterolateral bundle, and attaches anteriorly to the intercondylar eminence of the tibia and posteriorly on the posteromedial portion of the lateral femoral condyle. The ACL acts primarily to resist forces of anterior translation onto the tibia and secondly to resist internal rotation and abduction forces at the knee. The PCL is also an intraarticular ligament that attaches from the lateral aspect of the medial femoral condyle to a posterior and inferior position on the tibia plateau. Like the ACL, the PCL also consists of two bundles, the anterolateral bundle and a posteromedial bundle. The PCL primarily functions to resist forces of posterior translation onto the tibia and secondarily functions to stabilize against external rotation and excessive adduction and abduction of the knee. The medial collateral ligament (MCL) is separated into a superficial and deep bundle. The superficial bundle attaches from the distal femur on the posterior surface of the medial epicondyle and joints to the posteriormedial tibia and also blends with the fascia of the semimembranosus tendon. The deep bundle blends with the joint capsule and spans from the distal femur to the medial meniscus. The MCL primarily functions to resist valgus forces. The lateral collateral ligament (LCL) attaches from the distal epicondyle of the femur to the head of the fibula. The LCL averages 66 mm in length and functions to resist adduction forces along with internal rotation forces at certain degrees of knee flexion. Patients with knee OA are at risk for laxity seen at the tibiofemoral joint. Wada et al. reported increased anterior laxity at the tibiofemoral joint in patients with knee OA compared to healthy control subjects. Damage of the ACL was found to contribute to

this laxity. Furthermore, Lee et al. found deficiencies of the ACL in patients about to undergo TKA surgery, without any history of injury or instability. These findings imply that severe OA causes degenerative effects to the ACL. Similarly, Sharma et al. found that varus and valgus laxity increased with the decrease of joint space found in knee OA patients. It was concluded that the ligamentous attachments of the collateral ligaments moved closer together as a result of bone loss and cartilage degeneration and created a pseudo laxity for the MCL and LCL. This laxity can then further contribute to progression of osteoarthritis.

2.2.3 Cartilaginous Structures

The menisci of the tibiofemoral joint function to increase stability for articulations, distribute loading factors, absorb shock, and lubricate the joint. The menisci are crescent in shape and are located on the medial and lateral aspects of the tibiofemoral joint. The medial meniscus measures approximately 35 mm in diameter and attaches anteriorly to the tibia plateau and posteriorly to the posterior intercondylar fossa. The lateral meniscus covers a larger portion of the articular surface than the medial meniscus and attaches anteriorly, adjacent to the attachment site of the ACL on the tibia, and posteriorly, just posterior to the lateral tibial spine. The peripheries of the menisci are thick and have limited vascular capabilities while the inner portions are thinner and are avascular. Blood supply to the periphery includes the medial, lateral, and middle geniculate arteries. The menisci have poor healing capabilities due to their avascular characteristics. Long-term damage to the menisci may lead to degeneration of the joint, joint space narrowing, and symptomatic OA. The tibiofemoral joint uses articular cartilage to allow a smooth and lubricated surface for articulations and the transmission of loads without interference. Articular cartilage is 2 to 4 mm thick and does not contain blood vessels, nerves, or lymphatics, which creates a poor healing environment. A dense, extracellular matrix allows articular cartilage to retain water, which is key for its mechanical properties. Articular cartilage is separated into four unique zones: the superficial zone, the middle zone, the deep zone, and the calcified zone. The superficial zone is thin and makes up 10% to 20% of the articular cartilage. The main function of the superficial zone is to protect against shear forces. Collagen fibers of the superficial zone are tightly compacted and are aligned parallel to the articular surface, which allow this protection against shear forces. Beneath the superficial zone is the middle zone. The middle zone is the largest zone that makes up 40% to 60% of the articular cartilage. The middle zone functions to with stand compressive forces. It can withstand these forces since it is made of thicker collagen Fibrils, which are organized obliquely while the chondrocytes of this layer are spherical, and at a low density. The third zone of articular cartilage is that of the deep zone which contains the largest diameter collagen fibrils, the highest proteoglycan content, and the lowest water concentration. The deep zone makes up approximately 30% of the articular cartilage in which the collagen fibrils are arranged perpendicular to the articular surface. The deep zone functions as the primary resistance against compressive forces, and can do this given the high proteoglycan content and perpendicular fiber alignment. The last zone of articular cartilage is

that of the calcified zone, which functions to anchor the collagen fibers of the deep zone to the subchondral bone.

2.3 Osteoarthritis Etiology and Pathology

2.3.1 Multifactorial Etiology

Knee osteoarthritis has a multifactorial etiology including obesity, aging, and injury. Other less established risk factors include genetics, bone density, metabolic, and biomechanical implications. Neame et al. found that siblings of those with OA had double the risk of having knee OA themselves compared to siblings of those who do not have OA, with 62% of the disease variance being genetically determined. Similarly, Chitnavis et al. reported significant familial tendencies for symptomatic knee OA with siblings of those with OA showing two to five times the risk of needing a TKR due to idiopathic, end-stage OA. The study also found that one-third of the variance of OA seemed to be genetically determined. Finally, Spector et al. investigated the genetic variance of hand and knee OA in identical and non-identical twins. Genetic effects were found to explain 39-65% of the variance for hand and knee OA. Sowers found that nutrients may influence knee OA. Oxidative damage, implications of inflammatory responses, cellular differentiation, and problems with bone and collagen synthesis may all be affected by inadequate intake of nutrients. A study by McAlindon and Felson did not find any significant associations with micronutrients for the development of radiographic knee OA. However, for those already burdened with adiographic knee OA, a threefold reduction in the progression of OA was found in those with a high intake of vitamin C. The progression of OA was also minimally reduced with an adequate intake of beta-carotene and vitamin E. These nutrients provide antioxidant effects, which react against the oxidative damage seen at the knee from reactive oxygen species. The study also suggests that vitamin E acts against synovial inflammation that 13 accompanies OA by forming arachidonic acid from phospholipids and inhibits lipoxygenase activity. Sowers suggested that the pathology of OA has a relation to skeletal calcification, with OA patients showing higher levels of bone mineral density than those without the disease. Similarly, Hart et al. found increases in mean bone density for those with early radiological knee OA, showing that the two are inversely related. Higher levels of bone mineral density leading to knee OA is further confirmed by Hochberg et al., who found that higher levels of bone mineral density at the lumbar spine was associated with an increased risk of developing radiographic knee OA. This may suggest that although one may be protected from osteoporosis with higher bone forming tendencies, the same bone forming tendencies may actually increase the risk of developing OA. Altered biomechanics due to injury of the knee poses as a risk factor for knee OA. Chaudhari et al. investigated biomechanics of the knee in patients with an ACL injury and concluded that ACL deficiencies alter biomechanics, which then leads to the initiation of OA. Differing tibiofemoral contact patterns, anterior tibial translation, and altered tibial internal and external rotation may occur in the presence of an ACL injury. These changes cause

a kinematic shift at the knee in which degenerative forces are placed upon the cartilage. Areas of cartilage that are not conditioned to handling loads, along with reduced loading in areas of the cartilage that are conditioned to loading, may occur due to this shift, causing tissue breakdown. Lomander et al. researched female soccer players who had sustained ACL injuries and found that 12 years after the injury 51% of the females had radiographic knee OA.

3. AIM & OBJECTIVES OF THE STUDY

The aim of this study is to gather data about how knee osteoarthritis affects a person's quality of life. With this knowledge, we want to increase the understanding of physiotherapists and other medical professionals on how knee OA impacts a person's physical, social, and mental aspects of living. The effectiveness and satisfaction of the therapy can be improved when medical personnel have a greater grasp of the limits that knee osteoarthritis places on a person's life.

- The objective of this research is to ascertain the effects of knee osteoarthritis on a person's functional capacity and quality of life.
- Finding a solution to the topic of how pain intensity affects functional capacity and quality of life is another objective.

4. STATEMENT OF THE PROBLEM

- In the first of our study concerns is how functional capacity is impacted by knee osteoarthritis.
- How does quality of life suffer from knee osteoarthritis?
- How do people's functional abilities and quality of life change as a result of the severity of knee osteoarthritis-related pain?
- Considering participants in this study with and without knee osteoarthritis, how do quality of life and functional capacity differ between the two groups?

5. MATERIALS AND METHODOLOGY

PARTICIPANTS

The plan is to find a minimum of 30 people with diagnosed knee OA.

MATERIALS

The instrument for measuring pain is a pain diary. Functional ability will be measured by using two different tests, which are Timed Up and Go test (TUG) and Short Physical Performance Battery (SPPB). Quality of life will measure with RAND 36- item health survey. Describing tool of the study group will the Knee injury and Osteoarthritis Outcome Score (KOOS). Every participant will fill the health questionnaire form before testing to ensure participants safety during the testing.

METHODOLOGY

a. STUDY DESIGN

We will measure pain, functional ability and quality of life of the study group and functional ability and quality of life of the control group.

b. STUDY SETTING

The study will be carried out in Mathura.

c. SAMPLING TECHNIQUE

Convenient random sampling.

d. SAMPLE SIZE

A minimum of 30 people with knee OA.

e. STUDY DURATION

The study will be conducted for a period of 12-18 months.

f. SELECTION CRITERIA

Inclusion criteria

Study group inclusion criteria are female gender, age over 65 years, radio-graphic knee osteoarthritis (diagnosed by a doctor), experience of pain in the knee for at least three months, ability to perform the ADL-tasks and to live at home, ability to follow instructions and walk with or without a walking aid. Considering the fact that this study was focusing on the knee osteoarthritis and knee pain, the strongest pain had to be in the knee area.

Exclusion Criteria

Exclusion criteria are lower extremity replacement, other rheumatic diseases and doctor's prohibition to exercise.

h. METHODS OF COLLECTION OF DATA

To compare the results between study group and control group we will use parametric and nonparametric methods. We will use parametric t-test to compare TUG-test mean results between the two groups. In order to use the T-test, will compare samples must be normally distributed. If compared samples are not normally distributed, non-parametric Mann-Whitney's U-test is used. We use the latter test to compare RAND-36 and SPPB results between study and control group. Data processing and statistical analyses were performed using Statistical Package for Social Sciences.

i. OUTCOME MEASURES

- The Short Physical Performance Battery (SPPB)
- Timed up and go test (TUG)
- The RAND 36- item health survey 1.0 (RAND 36)
- The Knee injury and Osteoarthritis Outcome Score (KOOS)

6. RESEARCH HYPOTHESIS

Null hypothesis

'Does knee osteoarthritis affect on person's functional ability and quality of life.'.

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